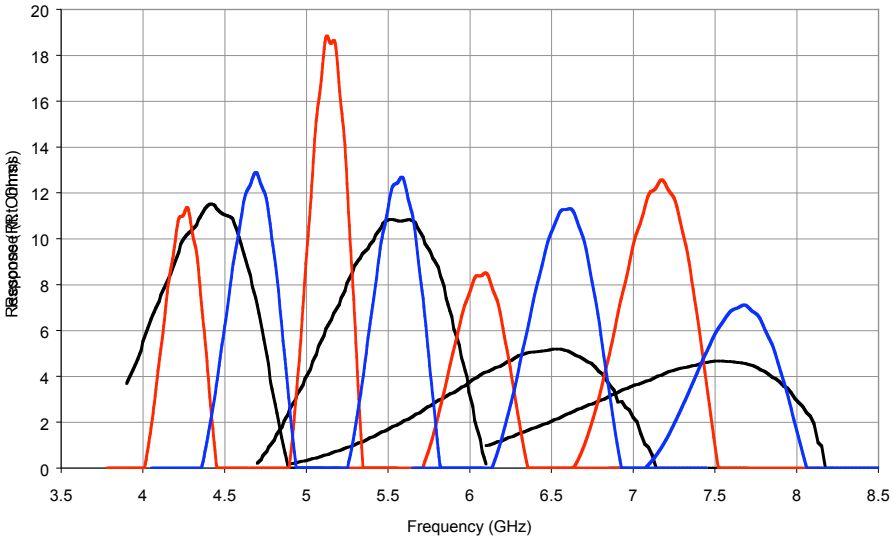
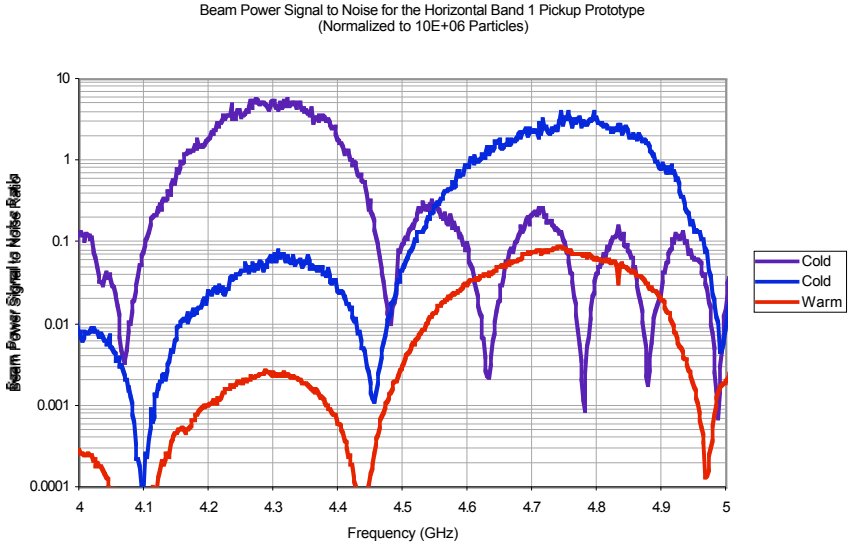
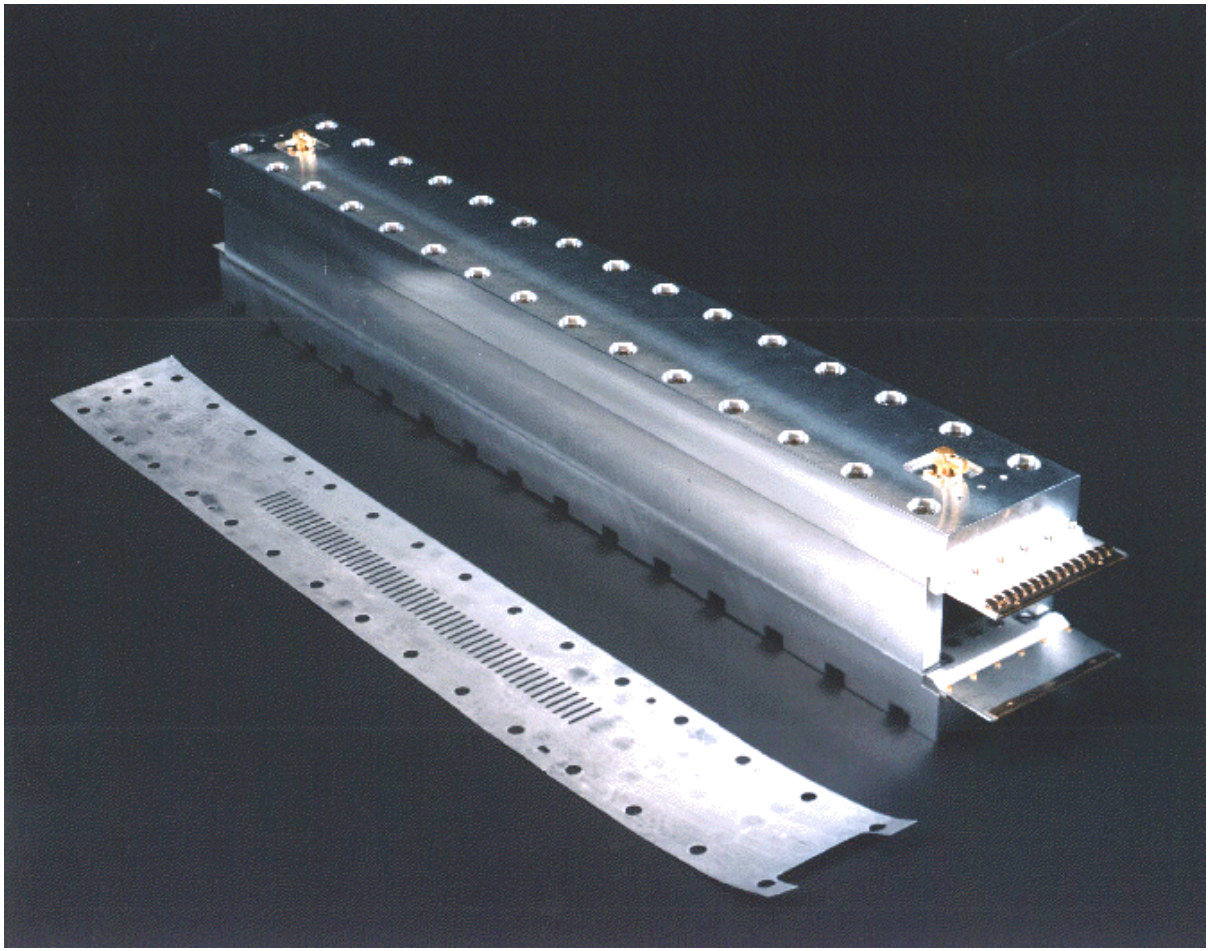
Debuncher Cooling

- 4 Bands of cooling
- Waveguide pickups and kickers
- Liquid Helium Temperature: Noise Figure ~30K
- Good signal/noise even for 10^7 particles
- Just transverse today





Slow wave pickups



Transverse Cooling

- Exponential Cooling Time: $\tau \alpha$ Intensity
- Power limited:
  - unable to run at 'optimal gain'
  - ramp gain through cycle to maximize power

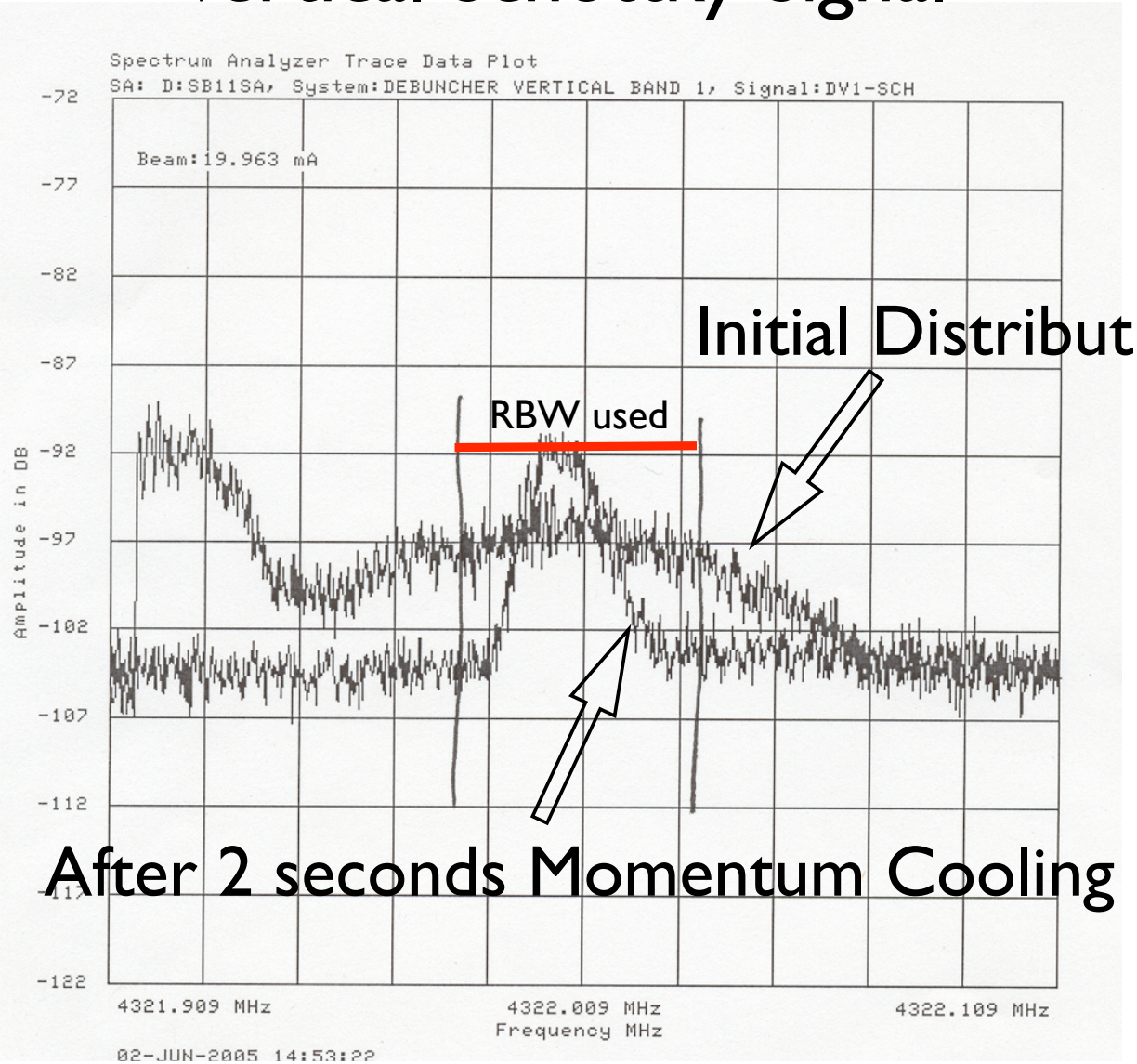
Transverse Cooling

- Difficult to measure:
  - Power in a βtron sideband ~ (ϵβ) N

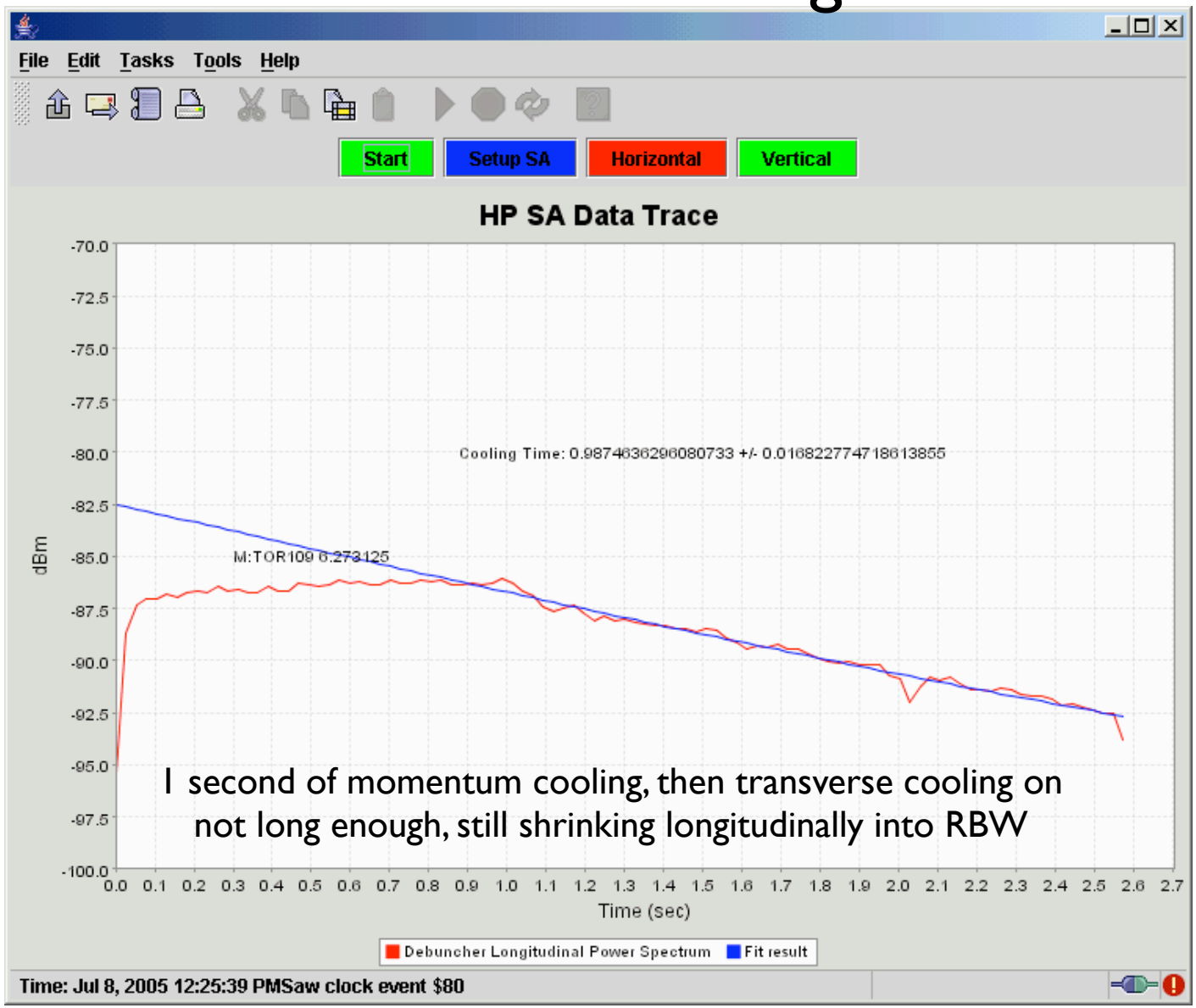
    dipole moment which is related to ϵ
  - disentangle longitudinal signal which leaks into transverse signals

  - hold off transverse systems until cooled longitudinally, signals separate and can be measured

Vertical Schottky Signal



Vertical Cooling



1 second of momentum cooling, then transverse cooling on not long enough, still shrinking longitudinally into RBW

Transverse Cooling

- Cooling Rates ~ 0.8 - 0.9 seconds for ~1.1e8 pbars
- Design Calculations: 0.75 seconds (Pbar Note 573, J. Marriner) for constant momentum, 1e8 pbars
- Working close to design values

40e10/hr?

- 40e10/hr ⇒1.1e8/sec
  - assume cooling time scales with N
  - 0.8 at 1.1e8 pbars, 30π acceptance

Cycle Time	N	τ	ϵ/ϵ_0	Transfer Aperture
2 sec	2.2e8	1.6 sec	0.29	8.7π
3 sec	3.3e8	2.4 sec	0.29	8.7π
4 sec	4.4e8	3.2 sec	0.29	8.7π

  - Final emittance independent of cycle time (for constant flux)
  - Current transfer aperture
    - ≤ 5.5π (Accumulator injection orbit aperture)
    - ≤ 3π (Mcginnis calculation Pbar Elog, 22 July 2004)